S. HRG. 99-106

THE LEAD FREE DRINKING WATER ACT

HEARING

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

NINETY-NINTH CONGRESS

FIRST SESSION

ON

S. 1197

A BILL ENTITLED THE "LEAD FREE DRINKING WATER ACT"

MAY 23, 1985

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CONTENTS

OPENING STATEMENTS

	Page
Bentsen, Hon. Lloyd, U.S. Senator from the State of Texas	3
Durenberger, Hon. Dave, U.S. Senator from the State of Minnesota	6
Lautenberg, Hon. Frank R., U.S. Senator from the State of New Jersey	2
Mitchell, Hon, George J., U.S. Senator from the State of Maine	2
Stafford, Hon, Robert T., U.S. Senator from the State of Vermont	1

WITNESSES

Bradley, Hon. Bill, U.S. Senator from the State of New Jersey	4
Howell, Richard, program director, office of sanitary engineering, Delaware Division of Public Health, Dover, DE	20
Murrell, Norman, senior vice president, engineering, H2M/Holzmacher, McLendon & Murrell, P.C. Melville, NY	15
Svenson, Richard, director, community sanitation and food protection, New York State Department of Health, Albany, NY	19
Background paper	31
Tucker, Robert, deputy director, New Jersey Department of Environmental Protection, Office of Science and Research, Trenton, NJ	13

ADDITIONAL MATERIAL

Maine Public Health Department, study from	27
S. 1197	43

THE LEAD FREE DRINKING WATER ACT

THURSDAY, MAY 23, 1985

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The committee met, pursuant to notice, at 10:34 a.m., in room SD-406, Dirksen Senate Office Building, Hon. Steve Symms, presiding.

Present: Senators Abdnor, Symms, Durenberger, Bentsen, Burdick, Mitchell, and Lautenberg.

Senator SYMMS. Good morning. Senator Stafford is having minor oral surgery this morning and I'm sure he would rather be here than there. I will read his opening statement to set the stage for today's hearing.

Opening Statement of Hon. Robert T. Stafford, U.S. Senator From the State of Vermont

This morning the Committee on Environment and Public Works will hear witnesses discuss problems associated with the use of lead pipes and lead solder in drinking water systems.

The focus of the hearing is a bill introduced by Senator Bradley, S. 1197. The goal of the hearing will be to identify what is known and not known about the extent of the hazards posed by lead in water systems and to explore possible steps the Congress might take to reduce these hazards.

The terrible effects that lead can have on human health is not news. It seems as if the more medical professionals and scientists study the question, the more harmful they find lead to be. The unborn, infants, and young children are particularly susceptible to damage to the central nervous system from excess levels of lead. And recent information is suggesting that lower than expected levels of lead in blood is related to hypertension in adults.

Lead in drinking water is one pathway by which people are exposed to lead. The lead in water supplies can come from several different sources, one of the most important of which is lead from pipes or solder in water distribution systems.

Senator Bradley's bill addresses this problem in two ways: First, it would impose a Federal prohibition on the future use of lead pipes and lead solder. And second, it would require water supply system operators to notify consumers of the hazards of lead and means to reduce their exposure to the substance.

I commend Senator Bradley for taking the initiative in calling attention to this potentially serious problem. I know his testimony this morning will be valuable.

We will also hear from four knowledgeable witnesses in addition to the Senator from New Jersey. These gentlemen will assist us by helping to define both the nature and scope of the problem, commenting on ways to reduce it, and sharing their views on appropriate governmental steps—whether Federal, State or local—to be taken at this time.

Information presented today will help the Committee and the Senate, in determining what legislative action should be taken at this time.

Senator SYMMS. Senator Bradley, on behalf of myself and the other members of the committee, I welcome you here this morning. We expect Senator Durenberger, the chairman of the subcommit-

tee, to be here shortly. I want to apologize to you before you start, I have to leave and go to the floor at this time, but I will take your statement and read it carefully. Welcome to the committee.

Senator Burdick, would you like to chair this hearing?

Senator BURDICK. If you can't get anyone better.

Senator SYMMS. There is no one better than Senator Burdick.

Do any of the members have opening statements? Senator Mitchell?

Senator MITCHELL. I do, Mr. Chairman.

OPENING STATEMENT OF HON. GEORGE J. MITCHELL, U.S. SENATOR FROM THE STATE OF MAINE

Senator MITCHELL. I want to thank you and Senator Stafford for prompt action in arranging this hearing on lead in drinking water and express my appreciation to Senator Bradley for his leadership and attention to this important problem.

There is no question that exposure to lead poses a serious threat to public health. Elevated levels of lead in the blood have been associated with birth defects, damage to the nervous system, and high blood pressure.

There is also no doubt that drinking water is a source of exposure to lead. While Federal and State agencies have taken action to limit lead associated with auto emissions and other sources, less attention has been given to the control of the levels of lead in drinking water.

I have not yet had a chance to fully evaluate the program proposed in the bill introduced recently by Senator Bradley, but I believe that we need to seriously consider the direct prohibition of lead in pipes and solder used in drinking water systems. Such direct prohibition of lead in pipe and solder would effectively complement the Federal standard for lead in the water from public water systems. Existing Federal standards provide important protection of public health but do not address water drawn from private wells. Private wells are very common in many rural States, including Maine.

The State of Maine's public health laboratories will soon release a report on the levels of lead in homes drawing water from private wells. An unexpectedly high number of homes tested were found to have lead in water at a level of concern. The report indicates that the occurrence of lead in these cases is associated with the use of lead solder.

Mr. Chairman, I ask that a copy of the report by the State of Maine's public health laboratory be printed at an appropriate place in today's hearing record. (See p. —.)

I look forward to the testimony of Senator Bradley and the other witnesses today, and I thank you, Mr. Chairman.

Senator BURDICK [presiding]. Senator Lautenberg?

OPENING STATEMENT OF HON. FRANK R. LAUTENBERG, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator LAUTENBERG. Thank you, Mr. Chairman.

I am pleased that we are holding this hearing so quickly. I am delighted to welcome my senior colleague, Senator Bradley, from our State, here this morning.

Yesterday, I joined him in introducing the bill to ban lead pipes and lead solder used in repairs and installation of water distribution systems. I am pleased that this issue has been put on a fast track because it deserves to be.

Two and one-half years ago, EPA determined that the largest source of lead in drinking water comes from the corrosion of pipes that carry water to the tap. What this means is no matter how much lead is taken out of drinking water by water supply companies, tap water can still be contaminated as lead is corroded from the pipes and lead solder connecting the pipes on its way to the tap.

Today, corrosion of lead from pipes is getting worse because one of the most serious environmental problems facing this country is acid rain. In our part of the country, water, acidified by acid rain, is eating away at pipes. These pipes are carrying lead to the homes of pregnant women, infants, young children, those who are most vulnerable to lead overexposure.

Using lead in pipes is not only unnecessary, it obviously can lead to tragic results. We know the effects of high blood levels of lead only too well. Damage to the central nervous system, learning disabilities in children, birth defects, and cancer are often attributed to exposure to lead.

We must do everything possible to cut back on human exposure to lead, whether it is in drinking water, automobile exhaust, or in paint or other products. A ban on lead pipes and lead solder is a critical component of the national campaign. To quote Senator Bradley, we must continue to get the lead out.

Action has been taken to ban lead solder in many States, Delaware, Oregon, Washington, Wisconsin, areas of Long Island, and abroad in Denmark, West Germany, Great Britain, and the Netherlands. Minnesota, New York, and several others are considering a ban.

I congratulate my colleague from New Jersey for the introduction of this bill, and I was pleased to join with him in sponsoring it. I congratulate the chairman for holding this hearing and for considering this legislation.

I look forward to hearing from Senator Bradley and the other witnesses. I also would like to take just 1 minute to welcome another New Jerseyite, Bob Tucker, from the New Jersey Department of Environmental Protection who has been helpful to this committee in the past.

Thank you, Mr. Chairman.

Senator BURDICK. Senator Bentsen?

OPENING STATEMENT OF HON. LLOYD BENTSEN, A U.S. SENATOR FROM THE STATE OF TEXAS

Senator BENTSEN. Mr. Chairman, my friend Bill Bradley has once more taken a leadership role in what is a very serious problem that is threatening our Nation.

For a long time we have known of the tragic problems resulting from lead in our environment, particularly in young people, birth defects, learning disabilities. We just can't tolerate that.

I am delighted to see that we have a panel of experts here this morning to discuss some of our concerns and problems. It is certainly right that this committee probe this issue and see what we can do, from a national standpoint, to address it. I wish I could stay for all the hearing, but I understand they have asked me to go over to the floor and get involved in the debate there, but I look forward to visiting with you afterward about it.

Senator BURDICK. Senator, you may proceed.

STATEMENT OF HON. BILL BRADLEY, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator BRADLEY. Thank you, Mr. Chairman, for the opportunity to come before the committee. Also, in absentia, let me thank Senator Stafford for being willing to schedule this hearing and consider this very important issue.

Yesterday, I introduced legislation to reduce the consumption of lead by unsuspecting Americans who may be drinking contaminated water. I am very pleased to say that my colleague on this committee, Senator Lautenberg, joined me in that effort.

As you know, lead is a dangerous substance that seriously threatens public health. There is substantial medical evidence detailing the problems associated with elevated lead levels in the blood.

A study by the University of Michigan Medical School which was reported in a recent issue of the Journal of the American Medical Association, concluded that a direct relationship exists between blood lead levels and high blood pressure. The report goes on to say that the effect was found even at blood lead levels less than the current toxic definition.

In addition, medical evidence indicates that exposure to lead is particularly hazardous to our children. The Harvard Medical School reported in March 1979 in an issue of the New England Journal of Medicine that exposure to lead can result in learning disabilities. In fact, this damage can occur at very early stages of exposure.

More recently, a joint effort by the University of Pittsburgh School of Medicine and the Harvard University Graduate School of Public Health looked into the relationship between prenatal exposure to lead and birth defects. The group reported that the greater the intake of lead, the higher the risk of birth defects.

We have long known of some of the dangers of lead poisoning. Let me remind you and the committee, Mr. Chairman, of the damage we have seen in children who have eaten peeling lead-based paints. But more problems are being uncovered daily as studies are concluded. We are only beginning to learn of the full health hazards associated with lead as newer medical findings are uncovered.

The risk of elevated blood pressure in adults, impairment of the central nervous system, retardation of learning ability in children, and birth defects all argue for prompt action to reduce the level of lead in our environment.

Most of the recent public discussion and attention has focused on the lead content of gasoline as a principal source of environmental contamination. As the committee remembers, last year on the floor, during deliberation of a tax bill, I proposed that we increase the tax on the lead content of gasoline. More recently, EPA has said that it would like to ban lead in gasoline.

While this issue must be addressed, another source of lead merits our attention as well, that of lead in our drinking water. In fact, a survey conducted in the Boston area by the EPA, Harvard University, and the New England Medical Center's Pediatrics Department found a direct correlation between drinking water lead levels and levels of lead in blood.

The EPA has concluded that lead enters drinking water primarily as a result of the corrosive action of water on pipes, fittings, and solder. Several factors come into play, two of the more important being the age of the plumbing system and the corrosiveness of the water. The highest levels are found in new systems with corrosive water that is allowed to stand for several hours. For example, the first several draws of water in the morning would be most contaminated. That is the effect when you get a new house that has lead solder in it, and you are advised by the real estate agent after you have bought the house to make sure you run the water a few minutes in the morning.

However, Mr. Chairman, levels in excess of the maximum contaminant level are not restricted just to these kind of circumstances. In our home State, Senator Lautenberg's and mine, New Jersey, preliminary work by the U.S. Geological Survey, in conjunction with our State Department of Environmental Protection, has confirmed that lead is leaching into drinking water in Ocean County and several towns along our coastal plain in amounts exceeding the EPA standard. If EPA reduces the level of lead which is acceptable in water, as they are expected to do, the number of communities which have a contamination problem will increase. Those are communities in New Jersey, but you can draw that conclusion as well in State after State across this country as states decide to look at the issue more carefully.

This problem of lead contamination in water, as I said, is not confined to New Jersey or to Massachusetts or even to the Northeast. It is widespread throughout the Nation. The States of Oregon, Massachusetts, Minnesota, Wisconsin, and Delaware have banned the use of lead solder and lead pipes in water distribution systems. Areas of Long Island and the city of Seattle have passed similar legislation. The States of California and New York are actively considering legislation to prohibit the use of lead in drinking water systems. And, Mr. Chairman, I add that these States have confidently predicted passage of such legislation. Other countries have taken similar action. Denmark, West Germany, Great Britain, and The Netherlands all prohibit the use of lead in water supply systems.

The bill that I have introduced is very simple. It is an effective vehicle for dealing with this problem. It would first ban the use of lead solder and lead pipes in any new construction of water distribution systems. We are not asking anyone to rip out old plumbing systems. Rather, we focus only preventive steps.

Second, it would require a warning label on the sale of all lead solder to protect unknowing homeowners who opt to perform their own simple plumbing tasks. The label would inform homeowners that they are using a product that is dangerous to their health.

Mr. Chairman, alternatives to lead solder exist which are equally, if not better, able to provide an effective seal without the adverse health effects. In light of the known medical dangers, there is no good reason to continue using lead.

Using alternatives will not result in any appreciable increase in costs to either homeowners or tenants. I ask you to consider that since only one pound of lead is required in drinking water plumbing systems in the average home, costs will rise from roughly $5 to $10 per home. Keep in mind, a $5 increase in a home that in many cases costs $65,000, $75,000, or $40,000 is negligible compared to the overall cost of the home and certainly a small price to pay to avoid the adverse health effects that could result from drinking lead-contaminated water.

The logic, I hope, is overwhelming to pursue this course of action. We place great emphasis as a nation on safe drinking water. Frequently, this requires expensive measures such as anticorrosive chemicals and fancy purification methods. What I have proposed is a simple, inexpensive, preventive step which we can take to avoid further contamination of our drinking water supplies.

I remind you, Mr. Chairman, and the committee that often the biggest problems are encountered in new homes. These homes are usually owned by young couples with young children, children who are particularly susceptible to the adverse effects of lead. I hope you will join me in supporting this effort to free our water supplies from further contamination.

Mr. Chairman, I would be pleased to respond to any questions that the committee has, and I hope that we will act on this soon.

Senator BURDICK. Thank you.

Senator DURENBERGER. Mr. Chairman, if I may make a few comments.

Senator BURDICK. Senator Durenberger.

OPENING STATEMENT OF HON. DAVE DURENBERGER, A. U.S. SENATOR FROM THE STATE OF MINNESOTA

Senator DURENBERGER. Senator Bradley and I have been trying to get lead out of various parts of our society now for several years. We met on the floor last week in his effort to use the Safe Drinking Water Act as a vehicle to accomplish that, and that is why we are here today.

I want to express my appreciation to the chairman of this committee for holding this hearing so quickly to help us ban lead pipe and lead solder in drinking water supply systems. I hope that through this hearing we are able to resolve those small problems, I trust, that prevented the Senate from considering Senator Bradley's amendment last week.

There is no doubt that lead is a health problem. Last year, this committee held extensive hearings on the health effects of lead and the benefits that would accrue from banning lead as a gasoline additive. After that hearing, the Environmental Protection Agency

took steps to ban lead in gasoline. Although the action will go a very long way in reducing exposure, it will not completely eliminate the problem of lead in the environment, because lead residues in soil, drinking water, and food supplies will continue to be a problem to Americans.

Several States have begun to take action on the lead pipe and lead solder problem. In my State of Minnesota, the health department has submitted a bill to the legislature which would ban lead pipe and lead solder in all new construction and would force retailers to label lead solder sold over the counter as a potential health hazard. I expect that bill will pass the legislature this year.

The health department is making this recommendation based on a survey, as Senator Bradley indicated, of new homes that it conducted last year. It found that lead contamination of drinking water supplies in the first draw can be several orders of magnitude higher than the current EPA standard of 50 parts per billion. At one multifamily building site, concentration registered in the survey was 33,000 parts per billion.

So, the Minnesota Legislature is in a good position to ban lead pipe and lead solder. The State of Minnesota sets the plumbing code for new construction and hires the plumbing inspectors. If the legislature decides that this material should be banned, then enforcement of its judgment will not be much of a problem.

I would suspect, however, EPA would have somewhat more difficulty in effecting a ban should the Congress decide to enact one as part of the safe drinking water law. So, one of our problems is the issue of enforcement.

A second problem is what to do about all the lead pipe and lead solder that is already out there. In some places, many places perhaps, the problem decreases as scale builds up on the pipe over time. But where water supplies are corrosive, some would recommend aggressive programs of correction to reduce potential lead exposures. The drinking water office at EPA ought to be the focus for designing that kind of corrective strategy.

As we learned at hearings of the Toxic Substances Subcommittee earlier this year, the good news is that EPA is already moving in that direction. So, I am convinced that national, State, and local agencies and legislative bodies are acting quickly to reduce future exposure to lead from a wide variety of sources. A national ban on lead pipe and lead solder would fit into that pattern.

But the real challenge will be to clean up the lead that is already out there in drinking water supply systems, in the crumbling paint in old buildings, and in the soil of city playgrounds. That will take a commitment of substantial resources and a strategy of detection and correction of careful design. I don't think the committee will be hearing the last of lead at this hearing today. I think that the health problems that it causes will continue to occupy our attention for years to come.

Again, I want to express my appreciation to the chairman of this committee for arranging this hearing, and for his support of the safe drinking water amendments that passed the Senate last week. I express my support to you, Senator Burdick, and all the other members on the other side of the aisle who are here for this hearing. I want to indicate to you that I met with Lee Thomas, the Ad-

ministrator of EPA, yesterday morning. He referred to the Safe Drinking Water Act Amendments of 1985 as a speeding bullet. If Senator Bradley can make that a silver bullet by helping us to reduce lead in our drinking water supplies, I am here to wish him all the best.

Thank you.

Senator BURDICK. Thank you, Senator. You have a problem of great dimensions. Everyone in this room, 240 million people in this country, drink water from pipes that have been soldered. You may be absolutely correct, but what do we do about the future? Do you know of any substance that can be used in place of solder to connect pipes?

Senator BRADLEY. Sure. There are a lot of things. Tin-silver, a tin mixture, could certainly be used. You have a variety of other kinds of materials that could be used. There is no problem with alternatives. For example, looking at cost, if you used a tin-antimony mixture, it would be about $10 per pound. If you used a tin-silver mixture, it would be about $20 per pound. So, there are clear alternatives.

Senator BURDICK. Have there been any tests of these materials? Will they last over a period of time as long as solder will? Will it last 2 years? Will it last 100 years?

Senator BRADLEY. They will last as long as lead solder. The point to be made here is that they will not be a direct public health threat. The action that I advocate is that we eliminate the threat that lead poses to our children and to our lives, especially since there are alternatives.

Senator BURDICK. I understand that perfectly, but I want to know what the alternatives are. Do you have the name of the substance?

Senator BRADLEY. Yes.

Senator BURDICK. What is it?

Senator BRADLEY. It is a tin-antimony mixture or a tin-silver mixture. These are two alternatives.

Senator BURDICK. And they are about the approximate cost of solder?

Senator BRADLEY. They are about $5 more per pound which means the average increase to ensure that your home is safe from the threat of lead is about $5 which, to me, seems to be a negligible cost.

Senator BURDICK. Well, all of us have been contaminated by this, haven't we?

Senator BRADLEY. I don't know, Senator. I don't know if you have lead pipes in your house or if you have lead solder.

Senator BURDICK. You have lead pipes. You have lead solder. Whether you have copper or maleable iron, you have lead solder.

Senator BRADLEY. That makes me feel very uneasy, Senator. If I have lead solder, which I more than likely do, one of the things I want to make sure of is that families who are building new homes don't have to contend with the threat that I have had to deal with. The fact of the matter is, when I turn the water on in the morning—and I live in the District of Columbia part of the time—I see a substance come out of there that I don't really want to drink, so I let it run for a while.

Senator BURDICK. Senator, I have become an amateur plumber. You didn't know that.

Senator BRADLEY. I didn't know that.

Senator BURDICK. That yellowish water that comes out is not from solder; it is from rust from a malleable iron pipe.

Senator BRADLEY. That is a warning, isn't it?

Senator BURDICK. No.

Senator BRADLEY. Whatever it is, I take it as a warning that metals can leach into my water and contaminate it, therefore, that I had better let it run. I don't care what the source is. It is like a neon sign that is warning me of a potential danger.

Senator BURDICK. But it is not solder; that is rust that comes out of there. And you know all the modern buildings have replaced the malleable iron with copper. You have a problem all right, but that isn't it.

Senator BRADLEY. As I said, it is a warning. I take the copper and the rust that comes out of that pipe in the morning as telling me to be careful, metals are leaching, one is probably lead since you have lead solder in your pipes. It is a threat to your health. It is a threat to your children's health. We don't have to have that.

While we are making light, a little bit, of the rust and the color, and so forth, the fact still remains, as you know as a person who has been in the plumbing business and knows plumbing better than most of us, that lead is a serious threat to the life and the health of our population, and there is no reason that we need to have it in our pipes. We can use an alternative with a $5 increase per house, and that alternative will ensure that we do not have to have the threat to our children that lead represents.

Senator BURDICK. If you have an alternative that will replace solder and last as long as solder and do the work, I am a 1,000 percent behind it.

Senator BRADLEY. Then you are a 1,000 percent with us. Thank you, Senator, for your support.

Senator MITCHELL. It must take you quite a while in the morning to get your first glass of water with all that warning ritual you go through.

Senator BRADLEY. What I do is take a shower before I take a drink.

Senator LAUTENBERG. From the same tap.

Senator BRADLEY. Right.

Senator MITCHELL. Did you get up at 5 this morning to make this 10:30 hearing?

Senator BRADLEY. No, I boiled the water in a cup of coffee.

Senator MITCHELL. Senator Burdick has talked about alternatives. That is one area on which opponents of your bill tend to focus, and you have responded to that. I am sure we will hear from opponents in rebuttal to your statements.

I would like to touch now on the other area that opponents of your bill deal with, and that is implementation. Your bill would require States to enact bans on the use of lead pipe within 2 years or lose certain funding. Can the engineering and plumbing industry identify alternatives? You already have mentioned two. And can they develop the needed skills in the use of those alternatives

within a 2-year period? Is that a realistic time within which this kind of change can be made?

Senator BRADLEY. I think it is certainly realistic, yes.

Senator MITCHELL. Your bill requires public water systems to notify their customers of the adverse health effects of lead in drinking water. Do you have any thoughts on providing people who draw water from private wells with the same information?

Senator BRADLEY. I am such a person, because in New Jersey, I get my water from a private well. I think that if we simply try to do as much as we can to publicize the danger of lead solder, that would be useful.

If a person gets water from a private well, being self-sufficient and self-reliant, one might argue, with some credibility problem but nonetheless still argue, that person is more than likely going to fix their own home. If there is a problem with the pipes and that person then goes to buy the lead solder that would be necessary to repair the pipe, we have, under our proposed amendment, a warning label on lead solder. I think that is probably the best way that we are going to be able to reach people who have well water.

Senator MITCHELL. I wonder if you might, Senator, with your staff and others who are involved in this, consider that aspect of it. There are some States, including mine, in which the number of people who receive their drinking water from private wells is very substantial. It really relates to density of population and availability of urban systems. I will say that I intend to do the same.

Senator BRADLEY. I would say to the Senator that I certainly will and I hope he will, as well. As I say, I get my family's water from a well, and it is a concern to me. I would like to try to figure a way that I can assure my wife and daughter that I have taken an action that helps us as well as all those who are building and buying new homes and who get their water from a public water system.

Senator MITCHELL. Your bill does not mention penalties for noncompliance for State adopted codes. Do you anticipate that States will provide penalties for the use of this material?

Senator BRADLEY. Yes. I think the States could provide penalties and should provide penalties. The way I envision the ban working is as follows: There exists about three or four major plumbing codes nationally. They are used throughout the country. We have plumbing districts that have been established to enforce the codes. What I expect as a result of this bill is that plumbing codes would be modified to essentially prohibit the use of lead solder and lead pipes. They would then enforce that at the local plumbing district level.

You could have EPA oversee that, and you could use the threat of loss of safe drinking water dollars if it was found that a State was in gross violation of the expressed intent of the Congress that the local plumbing district, overseen by the State, enforce that.

Senator MITCHELL. Thank you very much, Senator. Again, I commend you for your leadership in this area.

Senator BURDICK. Senator Lautenberg.

Senator LAUTENBERG. Thank you very much, Mr. Chairman.

A double problem that we in the State of New Jersey and other States in our area have right now is that we have a serious water

shortage. The first draw process says run your tap water for 3 to 5 minutes before drinking. But 3 to 5 minutes is the time alloted to take a shower. It is recommended by the State that you not use more than 50 gallons of water per day. Therefore, a 3-minute shower is enough time to conform to the 50-gallon-per-day usage level.

If you are going to open the tap in the kitchen for drinking or cooking water and you have to run it 3 to 5 minutes first, you have given up your shower for that day. Not to make light of it, but the fact of the matter is that we don't have the water to waste. It is sinful to have to run it that long to get what amounts to a reasonably safe level for drinking water.

Senator Bradley, I am just curious about something. I know you and I share an interest in this legislation, and I have joined you as a cosponsor. What about water supply systems? What the homebuilder has to do is take appropriate precautions; there is substitute materials for lead pipe or lead solder.

I was interested to learn that our esteemed colleague, Senator Burdick, is also an amateur plumber. He has a lot of talents. I didn't know that was one of them.

However, can a homeowner be assured that if they have taken the appropriate precaution of not having lead material within their home that they won't get a high lead content in their water from the distributor?

Senator BRADLEY. To the extent that the public drinking water systems comply with the Safe Drinking Water Act, I think that a homeowner can be reasonably sure. Again, that requires enforcement of the Safe Drinking Water Act as well as a ban on lead solder. I think that if the public systems meet the requirements, and if we pass this bill and ban lead solder, then homeowners can be fairly certain.

Senator LAUTENBERG. So that we are reasonably guaranteed that the water supply companies have a standard to conform to under the law and are obliged to do so.

Thank you, Senator. I am pleased to join with you in pursuit of this legislation. I think it is urgent.

Senator BURDICK. I have another question. Does your legislation apply to cities and villages and towns?

Senator BRADLEY. No. It applies to new construction only, new construction of homes. It requires, second, that a warning be put on lead solder when it is sold. So, it deals with that aspect of the problem.

Senator BURDICK. The reason I ask the question is that I know that in my hometown, and most of the towns in my State, the lead-ins from the water supply from the street come into the house and are composed, to a large degree, of lead pipe. Would the cities have to, in keeping with your theory, replace all those lead-ins?

Senator BRADLEY. This legislation doesn't address that problem.

Senator BURDICK. I would think that would be a far more serious problem with lead lead-ins than just a little solder in the copper joints.

Senator BRADLEY. I agree with you, Senator. If you would like to propose, in keeping with the spirit of my legislation, that public water systems replace all their lead pipe, I think that would be an

appropriate Burdick amendment. However, this program only deals with taking preventive steps in the construction of new homes. This is a small but important step, and I think we can test the waters to see if there is any, and I personally don't think there should be any, opposition to this kind of approach given what is the serious public health threat.

As I pointed out earlier and as I think Senator Durenberger pointed out in his statement, the problem is lead in our environment. I have gone countless times to the floor on the problem of lead in gasoline. The problem is that lead is a public health threat. We have a problem that is prospective which my bill addresses, new homes, new construction, the use of lead solder and lead pipe. We have to address the problem that has been created in another way.

Senator BURDICK. As I said before, if we have a substance that will replace solder and do the same job with a small increase in cost, no one would be against that at all. I hope we can hear from somebody in that field who can tell us what this product is you referred to. I think that is the answer if we have it.

Senator BRADLEY. Mr. Chairman, as I said to you, I think there are a number of other metal and plastic plumbing materials that could do the same job. I put out for the committee's consideration the tin-antimony mixture and the tin-silver mixture. I assume that you could object to that because it is an increase in price, but I don't find that increase in price too much a cost to pay to ensure the health and safety of our children which health studies have shown time and again are threatened by lead in our water systems.

Senator BURDICK. I want to thank you for your contribution this morning.

Senator BRADLEY. Mr. Chairman, thank you very much for allowing me to come before the committee. Senator Durenberger made a point about the threat of lead as a speeding bullet. I hope that this committee and the Congress will be faster than a speeding bullet in passing this legislation.

Senator BURDICK. If you would like to discuss with me about your personal problems with that well, I will give you a few minutes.

Senator BRADLEY. I have thought long and hard for various reasons as to whether this was susceptible to Federal solution, and I concluded that it was not.

Senator LAUTENBERG. Would it be appropriate for the Senator to introduce that legislation, but I could do it for you.

Senator BRADLEY. I thank the chairman very much.

Senator BURDICK. Our next witness will be Mr. Robert Tucker, deputy director of the New Jersey Department of Environmental Protection, Office of Science Research in Trenton, NJ. The other members of the panel will be Mr. Norman Murrell, senior vice president of engineering, H2M Consultants of Melville, NY; Richard Howell, program director, Office of Sanitary Engineering, Delaware Division of Public Health of Dover, DE; and Mr. Richard Svenson, director of Community Sanitation and Food Protection of the New York State Department of Health of Albany, NY.

Welcome to the committee, gentlemen. You may start in any order you wish.

STATEMENT OF ROBERT TUCKER, DEPUTY DIRECTOR, NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF SCIENCE AND RESEARCH, TRENTON, NJ

Mr. TUCKER. Thank you very much, Mr. Chairman. It is a pleasure for me to be here from New Jersey and to have both Senators from New Jersey particularly sensitive and supportive of public health issues and the environment.

We are currently investigating a problem with lead in drinking water in Ocean Township, as Senator Bradley indicated. With me from New Jersey today is Mr. George Kish who is the principal investigator from the U.S. Geological Survey in Trenton and who is heading this study. Also with us is Mr. Robert Mueller from our office who is the liaison with USGS.

I want to make a point at the outset, though, that the people in the areas affected in Ocean County are not currently drinking the water. It is the usual practice in New Jersey as soon as we find a problem where there are standards violated that alternative water supplies are found. These people are now on a public water supply or other alternatives.

I also want to emphasize, as has already come up in the discussion, that the lead pipe situation is just one of a myriad of problems, and New Jersey has had its share of problems in this area. I should report that one of our State senators, Frank Gray of Patterson, steered a bill through our State legislature to get more money, and Governor Kean recently signed this bill, which would give substantial additional funding for diagnosing lead poisoning in children.

We have had problems with lead pica in the inner cities, children eating paint chips. We have had situations in our cities of battery reclamation operations or small smelters that have emitted lead. Of course, we have had the legacy of lead exposure from gasoline. Fortunately, lead additives are being phased out. But there is still substantial exposure from that source, in essence a pool of lead in the environment that could be leached additionally into drinking water under the right conditions.

For the last year, I have been chairing a task force for our Governor's Council on the Prevention of Mental Retardation. The issue of lead was very seriously considered. In fact, in New Jersey, this council felt that eliminating exposure to this element was one of the two top priorities for preventing mental retardation.

Dr. Steven Marcus of our State health department who is head of the New Jersey Poison Control Center and who is a pediatrician with extensive clinical experience with children with lead exposure and lead poisoning considers lead exposure and lead effects extremely serious in New Jersey. As I said, we have had substantial problems in some of our major cities with exposure via paint chips.

Senator Bradley made the point about families with young children going into new housing. Our State supreme court, through the Mt. Laurel decisions, has mandated affordable housing in New Jersey for families of low and moderate income. I think it would be a terrible irony if families from the inner cities who were able to move out to the developing areas and get decent housing would continue to be exposed to lead. So, I certainly support doing away

with all of the potential sources of exposure to lead, particularly for children Actually for all of us, because more recent studies, as Senator Bradley mentioned, show that low levels of lead can lead to cardiovascular problems in adults, perhaps by promoting renal hypertension.

Lead is a serious health problem, particularly in terms of neurological development. As our council on prevention of mental retardation noted, more and more data is indicating subtle effects at low-lead levels. We have a history of having the effect level get lower and lower as better measurements are made. We are getting to an area where it is very difficult to determine biological effects, but studies that have been done, the Harvard study by Needleman, for example, have indicated serious developmental problems as a result of exposure to lead.

One of the things that our public health people in New Jersey have made a very great point of is that the role of nutrition is extremely important in preventing the effects of lead exposure on kids that continue to be exposed to lead. It is very important that maternal and infant and child nutrition be maintained in order to combat the exposure that still remains. I think one of the most important steps that the Congress could take would be to continue the kinds of programs that support good nutrition. I realize that is a little bit off the subject of lead in water, but it is closely related to the total problem. Because we in New Jersey have experienced the problem in a number of aspects, I did want to put that into perspective.

To say something specifically about the study we have ongoing in Ocean County, in 1982, as a result of a complaint, we started investigating wells in several townships. Preczewski and Hayes of our division of water resources did a detailed study in conjunction with the Ocean County health department to try to scope out the problem. They generated some preliminary hypotheses, but there were real questions as to what might be causing high levels of lead in about 15 percent of Beechwood homes and 6 to 8 percent of Berkley Township homes.

Evidence that solder in copper piping in homes may be a problem is that, as has been mentioned, pumping or draining the water after standing does have a substantial effect on lowering the levels of lead in subsequent samples.

Currently, the U.S. Geological Survey study is trying to get much more detailed information on the rates of leaching and the possible contributions of the characteristics of the water itself to this problem. Our coastal plain geology is characterized by water that already is of a naturally low pH; it is a very acid water.

There have been concerns that additional acid deposition may contribute to leaching of natural or man-engendered lead deposits in the environment and also that it may increase the aggressiveness of water in home systems which would contribute to leaching lead into the water as it stands in the system or flows slowly in the system. The preliminary data does indicate that you get much higher levels of lead in the morning after the water has stood in the system overnight.

New construction seems to be a greater problem than lead levels in older homes. This may be due to the eventual coating of pipes,

probably a process of forming lead carbonate deposits in the pipes. We need to know a little bit more about the characteristics of the water, the chemistry, the corrosiveness of the water and the characteristics of plumbing systems.

As has been mentioned, there are other studies that have confirmed the seriousness of the contribution of solder to lead in the domestic water systems. Based on this, and our own preliminary data, we certainly support getting rid of solder as a contribution to lead in plumbing systems.

The additional research that the USGS and our office has planned would be to get at problems of leaching in the ecosystem, definitions of the water and soil characteristics and the contribution of acid deposition to the overall problem.

Thank you very much.

Senator BURDICK. Thank you.

Our next witness is Mr. Murrell.

STATEMENT OF NORMAN MURRELL, SENIOR VICE PRESIDENT, ENGINEERING, H2M/HOLZMACHER, McLENDON & MURRELL, P.C., MELVILLE, NY

Mr. MURRELL. Thank you, Mr. Chairman.

The problem that we see is that lead is leaching from solder. Our study and other studies have shown it throughout the United States. A second problem is lead is not indicated on packages of lead solder. Third, there is no warning of the health effects of lead on the packages of lead solder.

We became first involved 2½ years ago with a dentist's son who had lead poisoning picked up by blood samples. The drinking water standard for lead is 50 parts per billion. The dentist took a sample, and the lead was 1,900 parts per billion in the first draw. Since we have been taking samples for 15 years and hadn't picked up lead, we doubted it, so we had him take another sample. It had 1,600 parts per billion of lead.

We then sent out a regular sampler and followed standard procedures of running the water 3 to 5 minutes and picked up only 27.5 parts per billion of lead. At that point, we realized the standard procedure of sampling water supplies by running water 3 to 5 minutes was obtaining samples of the distribution system through the home plumbing which the residents are drinking. Further tests in the house indicated zero and 1 minute tests of 900, 3,900, and 500 parts per billion in that home.

The tests in that area and other areas indicated that the water supply system was lead free, but there is a residential plumbing problem from new lead soldered joints. We did a literature search and found out these problems had been studied throughout the world, in England and Norway, Denmark and Scotland.

Part of the problem is soft water and also a low pH or acid water. On Long Island, for instance, water comes out of the ground at between 4.5 and 6.5 pH with neutral being 7. The State health department requires that water be supplied at between 6.5 and 8.5. We have very soft water which is down between 5 and 4.5.

Getting back to the dentist's home with the lead poisoning, we did a timed test of every 10 seconds on how much lead was in the

faucet. It started with 300 parts per billion and dropped down. It took about 48 seconds of flushing the water before you got below the drinking water standard.

We also did a study of all those homes in that subdivision which was about 8 years old. We had problems with high lead in three locations. The dentist had just added a filter on his house to protect the family's water supply, and the solder was caked around the filter and that is where he was getting his lead from. Across the street, another home had additional new plumbing, and they were getting lead. Down the street, there was a new home under construction. We checked that and found 7,100 parts per billion lead in the first draw. In that home under construction, it started at 2,500 parts per billion and water flowed for a full 80 seconds and we still did not get below the drinking water standard.

At our own office in Melville, I sampled after a 3-day weekend back in 1982 right after the Christmas holiday. I went in and tested and took a time series of tests. I had a man go up into the ceiling area, measure all the piping, locate all the joints, and calculated from the size of the pipe where the lead joints were. It started with 160 parts per billion at joints under the sink. There was a run along the roof where lead values ranged 50 to 105 parts per billion. We got to a point where it turned down to go into a bathroom where lead values were 200 parts per billion. That was three or four joints where we got the highest value and then it went down to where it connected to a 4-year-old part of the building and then it was below the drinking water standard. The building was 23 months old.

Initially, in the first few months, we did 200 tests in Nassau and Suffolk Counties on the first flush values and obtained lead values of 7,100, 3,900, 2,500 parts per billion and down, all well above the drinking water standard at various locations. When we let all the health departments know, at first many of them had doubts. Nassau County Health Department went out and studied and tested new homes with 47 and 61 percent lead solder and found a high value of 17,000 parts per billion of lead with a 7 or neutral pH water. Another home was 4,400 and another 3,500 parts per billion of lead. Incidentally, the one with 4,400 was 1 year of age.

Other data was obtained by the Hempstead water department which went out and tested in East Meadow and Uniondale and other locations. They obtained a high value of 2010 parts per billion. They had a higher pH in their systems. But even here on a house that is 8 months old, even after 1 minute of flushing it was still 380 parts per billion of lead or well over the 50 parts approved for drinking water.

Recently, in eastern Long Island, under a blood screening program for lead, they picked up in 2½ year olds with 44 micrograms of lead per deciliter and 41 in two consecutive blood tests. The Suffolk County health department went out there and tested. At the first flush, they obtained 160 micrograms per liter or parts per billion and 46 after 3 minutes.

They asked us to do further studies as long as we kept it confidential as to who the child was. We went out there and interviewed the mother, and she said the day before she had looked in the strainer screen on her faucet and found all lead chips in there and

had thrown them out. She also said that a neighbor had told her don't give a baby milk when they go to sleep at night, so she gave her a bottle of water every night when she went to sleep from this upstairs tap. We went to the upstairs tap and without any lead chips in the screen, we obtained 250 parts per billion of lead, and it dropped down after a period of time. This was a private well, as discussed prior to this. The pH was 6.2 and the solder had 56.2 percent lead in it.

As you discussed today, there is a whole range of health effects from lead. Ones I would like to just touch on briefly are brain damage and nervous disorders.

An interesting study was just recently released last July by the University of Wales and the Wharfdale General Hospital. They went to homes with water services that were not lead pipe but had lead solder on copper piping. They tested five different locations in a major city where there was 30,000 to 40,000 vehicles per day, a secondary city with 27,000 vehicles per day, and going down to a small village of 500 vehicles per day and checked even 30 homes on cul de sacs where there was practically nothing per day in traffic. They checked air samples one meter above the living room floor and dust samples from the vacuum cleaners. Their conclusions from statistics after all the tests was that although none of the areas had high levels of lead detected in the water supply, water emerged as an important contributor to blood levels and it had a greater contribution to blood levels from water than from air.

I think this chart was mentioned before. The Boston Hospital for Women tested umbilical cord blood from 5,182 consecutive births. They were analyzed for lead. Boston has a high amount of lead in the water service, as does the city of Chicago. The conclusion was that the incidence of minor malformations was associated with cord blood lead levels. Minor malformations were undescended testicles, minor skin malformations and minor non-malignant tumors.

In the St. Louis area, a group of schools and hospitals did a test of 66 sudden death syndrome infants and they compared it to 23 infants who died suddenly from accidents or other causes. The infants were between 4 and 26 weeks. There was 68.5 percent more lead in the ribs of the sudden death syndrome infants and 43.9 percent more lead in the liver.

Over in Scotland again, they did a study of 77 mentally retarded children of ages 2 to 6. They had higher water lead levels in homes occupied by the mother in pregnancy and homes occupied by children in the first year of life. They compared this to 77 nonretarded children with match controls, and the nonretarded had much lower water lead levels in their homes.

This has been discussed before, another Boston study saw a fourfold increase in the risk of having an IQ below 80 in a high lead group. Another study took 2,146 children where they checked the dentine lead level of the teeth and they also obtained an independent teachers' rating of 11 negative classroom behaviors. When they put it all together, it turned out the children with high lead levels in their teeth were also the ones that were distractable, not organized, frustrated, daydreamers, and couldn't follow simple instructions.

Back in 1977, the National Academy of Sciences came out with a report and recommended for infants that lead in drinking water—shouldn't be 50 parts per billion but insead—25 parts per billion as a standard.

Going back to the Roman Empire, there was lead pipe used then. The aristocrats were the only ones who had lead pipes. Look what happened to them on this chart.

We are doing a lead solder aging study for the South Huntington water district. We are testing 90 homes in each of three different pH ranges. The first draw lead from the 250 different test sites show that 58.7 percent have lead values above the drinking water standard at low pH. At a medium pH of about 7.2, there are 25.6 percent homes that are above the drinking water standard. At a high pH of about 8.2, there are 24.4 percent homes that have lead levels above the drinking water standard.

With regard to the aging of solder, most of these high lead values occur in newer homes constructed between 1980 and 1983. At low pH, 68 percent of the homes exceeded the drinking water standard. In older homes, built between 1965 and 1979, only 15 percent exceeded the drinking water standard. At medium pH and high pH, there were 28 and 27 percent of the newer homes and only 4 and 2 percent of the older homes which shows there is a correlation with the aging of the solder.

As discussed before, Minnesota was kind enough to give us their studies of 46 communities less than 3 years of age. Of the 46, 17 or 37 percent exceeded the drinking water standard. In new construction, the 33,000 parts per billion lead figure was previously mentioned and of the 25 communities tested, 19 or 76 percent exceeded the drinking water standard.

In New Jersey, Wisconsin, Pennsylvania, and Virginia we also have lead leaching problems.

In talking about common drinking measures, taking the 29th highest home in the U.S. EPA South Huntington study, a child taking a drink in the middle of the night from a fruit juice glass would get 465 parts per billion of lead. A quart used for coffee in the morning would have 140 parts per billion of lead. Even a gallon of water would have 53 parts per billion of lead.

We should be concerned because of all the housing starts in the United States which in the last 2 years were about 1.7 million per year. The lead industry says that 6,000 tons per year of lead solder joints are used in copper plumbing.

There are alternatives, tin-antimony or tin-silver with only a slight increase in the temperature needed to melt the silver and only a slight increase in cost. Plumbers say that less than 1 pound is used per home.

There are lead solder bans now in 13 towns in Nassau and Suffolk County. Lead solder bans were initiated throughout the country starting with Seattle back on June 23, 1980. The first State to ban lead solder was Delaware in 1984. In New York State, there are 931 towns and 553 villages. Legislation to ban lead solder passed last Monday, May 20, in the assembly and is in the second reading in the Senate. It might be passed there tomorrow.

Recommendations made to various towns include plumbing code changes, notification to plumbers, and notification to the stores to alert all those do-it-yourself plumbers.

We have a problem with monitoring in the town of Smithtown. They take a scraping of the solder. The first 10 tested had 5 violations. In the second 10, there were 6. In the town of Huntington, where we tried to carry on with our lead studies, 62 percent are in violation since their ban. In the village of North Hills, 30 percent are in violation. In the town of Brookhaven, we have a number of violations.

Last Sunday, I purchased lead solder at a store. There was no indication on the packaging that it is lead solder. There is no warning, of course. We tested it Tuesday and found out it had 63.4 percent lead in it.

Our conclusion is that lead solder should be banned to protect our children throughout the Nation and you should require warning labels on lead solder.

Senator BURDICK. Thank you.

Do the other gentlemen want to be heard?

Mr. SVENSON. Mr. Chairman, I will try to be brief.

Senator BURDICK. All right.

STATEMENT OF RICHARD SVENSON, DIRECTOR, COMMUNITY SANITATION AND FOOD PROTECTION, NEW YORK STATE DEPARTMENT OF HEALTH, ALBANY, NY

Mr. SVENSON. I am here today representing Dr. David Axelrod and the New York State Health Department, and appreciate this opportunity to reinforce the need to get the lead out of solder and drinking water plumbing. In New York State, for the last 15 years, there has been a huge amount of Federal, State, and local governments and private moneys spent getting lead out of our environment; revewel of lead paint; construction of industrial waste water treatment plants, unleaded gasoline, et cetera. Dr. Axelrod has reminded me that lead is an element that has no health of nutritional benefit to our population. I believe no one could argue with that point.

In New York State, right now, as Mr. Murrell has outlined, there is a ban in most of Long Island's communities. As he has also updated you, State legislation is now in front of our State representatives for enactment. I feel that there are readily available substitutes, to lead solder and that this issue is one that can be resolved very quickly.

The particular approach reflected in the proposal at hand is the right way to proceeds; amending the State's plumbing code and local codes. In order to get enforcement, it must be coordinated with the local plumbing officials.

In New York State, we have a uniform code, which would make uniform enforcement easier. Other States may not have a uniform code. I am sure it would be much more cumbersome where a lot of individual codes exist in a State.

An important point was made earlier about populations served by wells. In New York State, 11 percent of our population, mostly in upstate New York, are served by individual wells. These people

should have protection. We have experienced a number of severe and tragic incidents of lead poisoning in children served by wells that have corrosive water. So, I feel a Statewide ban approach is appropriate to affect not only the public water supplies but also the private water supplies in our State and throughout the country.

The banning of lead solder and pipe in new construction of the prvention package produced over the last 15 years in Washington; "getting the lead out" and treating the issue as a national problem. I hope that my State will have a regulation in place sometime in the future. I think the point made as far as amending the primacy, a number of States requirement may cense a problem at amendment will be a statewide mandate and go further than public water supplies.

To answer the concern regarding substitutes, I, as Mr. Murrell and other public health engineers have said who have some experience in plumbing, the substitutes of tin-antimony and tin-silver are readily available. The plumbing industry has used them for years. In fact, I know right now there is a union in California that is lobbying for the lead solder ban to be enacted by the California legislature. So, I feel the plumbing industry should have no problems in handling this particular substitute. As far as additional costs, depending upon the price of silver—silver would be $5 or $10 per pound more than the lead solder—so maybe we will have a "silver bullet" soliders if we use that particular kind of solution in place of lead.

The New York State Health Department is clearly in support of getting the "lead out." I would be glad to answer any questions you may have.

Thank you.

Senator BURDICK. Thank you.

Mr. Howell?

STATEMENT OF RICHARD HOWELL, PROGRAM DIRECTOR, OFFICE OF SANITARY ENGINEERING, DELAWARE DIVISION OF PUBLIC HEALTH, DOVER, DE

Mr. HOWELL. Thank you, Mr. Chairman.

My name is Richard Howell. I am pleased to be able to have the opportunity to testify today. I am the director of the office of sanitary engineering of the Division of Public Health for the State of Delaware.

We are here today to acquaint you with some recent activities in our State concerning lead solder in potable water systems. As a preface, I should explain to you the administrative setup within the Delaware Division of Public Health. The division of public health is the administrative unit for public health programs in Delaware. The office of sanitary engineering is a subunit of the division of public health. Activities within the office of sanitary engineering include administration of the public water supply supervision program and the statewide plumbing code, along with other water related activities.

In Delaware, the State board of health has been delegated authority by the legislature to adopt regulations concerning public water supplies and the statewide plumbing code. The division of

public health administers these programs and enforces the requirements of these regulations.

The State board of health has appointed a board of plumbing examiners whose primary purpose is to provide for the licensing of plumbers, to discipline plumbers if needed, and to generally advise the State board of health regarding the technical aspects of plumbing and plumbing materials.

As a result of activities dictated by the Safe Drinking Water Act, which is being enforced by the division of public health since obtaining primacy from the Environmental Protection Agency on April 2, 1978, elevated lead levels were detected in a number of public water supplies.

Upon investigation, several instances were detected. One was in a community water supply—municipal system—and the source was traced to lead goosenecks. The second was a community water supply that was a nursing home. It was a newly constructed facility with copper pipes and lead solder. The third was a copper pipe installation in a hospital, a very large hospital. Again, it was newly constructed with copper pipe and 50–50 lead solder. The most recent case that we had prior to our regulatory change was another nursing, again a newly constructed facility.

Concurrent with these investigations, a number of other instances were brought to our attention in both public and private water supplies. The board of plumbing examiners was considering revisions to the State plumbing code. The results of these investigations were presented to the board of plumbing examiners, and the matter was thoroughly discussed by them over a period of several months.

As a result, the board of plumbing examiners approved an amendment to the plumbing code for submission to the State board of health for final approval. This amendment would ban the use of solder containing more than 0.2 percent lead for use in potable water systems.

This matter was discussed at trade association meetings, and public officials within the State at the city and county level which enforce the plumbing code were notified of the proposed action. A public hearing was held on November 9, 1983 to discuss these proposed amendments. The State board of health formally adopted the proposed regulations on December 19, 1983 with an effective date of February 1, 1984.

Attached to the paper that I have presented is an appendix which is a brief report which gives some of the detailed statistics of our findings. I am not going to go into that at this time, but it is available in the written testimony.

Plumbing inspectors in the field have reported no unusual problems with the implementation of this regulation, and they feel that they have had very good voluntary compliance. In case of dispute as to whether or not solder in violation of the code has been used, we have the capability to chemically analyze this if necessary. In the event of serious noncompliance with this or any other regulation, the individual plumber is subject to a hearing before the board of plumbing examiners which could result in penalties as severe as revocation of his license.

We feel that the recent restriction on lead content in solder for potable water piping has been beneficial to the residents of the State of Delaware. Several methods have been and are continuing to be explored to solve this problem. We feel that the solder restriction has advantages. One, it affects both treated and untreated public water supplies and individual wells which are not normally regulated under the Safe Drinking Water Act. We have eliminated a demonstrated source of lead in the human diet by prohibiting the use of lead-containing solder. We are not dependent upon the operation and maintenance of a treatment system and, consequently, have, for practical purposes, eliminated lead from this source.

In summary, we feel that the best solution to the problem of lead contaminants in drinking water is multifaceted and includes the control of plumbing materials, the control of the corrosive nature of water, and continuing monitoring to determine the extent and nature of lead contamination in drinking water from all sources.

Gentlemen, let me thank you again for the opportunity to testify on this important matter. As a native of Delaware, I am proud to have had a part in making Delaware the first State once again. Thank you.

Senator BURDICK. Thank you very much.

I don't think that anybody would object to the substitution of the material you referred to take the place of solder. No one would object to that.

But I am wondering if you are not going to have problems. Listening to you, Mr. Murrell, talking about the supply system and the percentage of lead, and so forth, but that lead was contained in the supply system that comes to the house as well as in the house, was it not?

Mr. MURRELL. No, sir. We checked the water in the distribution system, and there was no lead in the distribution system. It was what was in the house from the house plumbing and the lead solder.

Senator BURDICK. You mean to say you tested that from the meter to the faucets inside the house?

Mr. MURRELL. Yes. We took the coupling out and checked at the meter. We checked hydrants in the area and other locations to know that the distribution system was all right.

Senator BURDICK. What about those areas in many parts of the country that have 50 to 100 feet of actual lead pipe leading to the meter.

Mr. MURRELL. Right. Many major cities like Boston and Chicago and New York City still have lead services, but that is sort of a separate problem.

Senator BURDICK. It is a separate problem but much bigger than the solder problem. That is really the problem.

Mr. MURRELL. There was a study done in Scotland of a home with blood leads checked which had a lead service line and a lead lined tank. As controls, they did 13 other homes with copper services and 12 other homes with lead services, and they found out that they got higher leads out of the lead solder in newer lines than they did out of the old lead lines.

Senator BURDICK. Well, this is one part of the testimony that I want further evidence on. As far as replacing the solder, there is

no question about that, but my only question is are we getting at the problem.

Senator Lautenberg?

Senator LAUTENBERG. Thank you very much, Mr. Chairman.

I just have a couple of things because the time has flown by. The testimony is very interesting. I think it was very professionally done.

Mr. Murrell, I compliment you on your study. Who did you do this study for?

Mr. MURRELL. The first year, we just did the study on our own. Then, from October 1983, part of our studies have been for the U.S. EPA and the South Huntington Water District, as a cooperative study.

Senator LAUTENBERG. It wasn't a commission initially because something triggered the curiosity?

Mr. MURRELL. No. It was just triggered by curiosity about the lead poisoning case in Smithtown.

Senator LAUTENBERG. OK. All of you agree that this legislation should go forward, that it is the right thing to do? Is there any question about that?

[Chorus of noes.]

I have to ask you a question. Here we have a distinguished Representative of my State and a distinguished Representative of our sister State, New York. Tell me, if you would, briefly, because we are really under pressure, if this goes back to the Roman Empire, why the devil has it taken so long to get this underway? What has happened to us in New Jersey?

Mr. TUCKER. Let me see if I can at least provide a partial answer. We have been in the process of reducing a number of sources of lead. In the past, lead in gasoline may have been a more important exposure source. Lead in paint in the inner cities was also seen as a more significant exposure source. We are reducing gradually this multitude of sources, and as we do this, the contribution of lead in drinking water is proportionately greater. I think at this point, we need to act.

Senator LAUTENBERG. Did I misunderstand or is the drinking water supply tainted by lead the most direct cause for higher blood lead levels? Mr. Murrell, would you agree with that?

Mr. MURRELL. Well, there was a study in Wales at the Wharfdale Hospital there which indicated that probably there was as much coming from the lead as from the air when they studied five different localities.

Senator LAUTENBERG. OK. It is bad for us no matter where it comes from, but here is one source that could have been eliminated.

Mr. SVENSON. Let me just add a couple things. It probably hasn't been made clear there are certain conditions that have to occur in the water supply. Mr. Murrell reviewed these; you may be familiar with these variables known as pH, alkalinity, and temperature. Certain water supplies don't have a corrosivity problem. You may have some leaching but it may not be significant.

With that also, there is acid rain that has occurred in New York, and that has been shown in upstate New York as causing more problems and attacking that particular metal.

Basically what has happened over the years, and I have been involved in this 17 years, we have gone to the big sources. Now that the medical community has looked at the phenomenon of lead and mental retardation and other areas such as kidney dysfunction, they have decided let's get it all, let's get it all out. So, it has been an incremental approach.

The big pieces have been bitten off. This one is a small piece, I feel, and I think your question is right on. Why haven't we done this if we have readily available solutions? What has been holding it up? It has been that some water systems don't have a problem, and even with the systems that have a problem, over several years it goes away depending upon the characteristics of the water supply.

Senator LAUTENBERG. I guess an analogy that comes to mind is that although everybody doesn't get shot at by criminals, we have laws that protect the whole society because the possibility is there. This seems like a relatively easy turn to make, and I don't understand why States, particularly our State, Bob, have not moved quicker on this issue.

Mr. TUCKER. Senator Lautenberg, one possibility, too, is that our past sampling techniques may have lulled us into not realizing the seriousness of the problem. The standard operating procedure for sampling was to flush the system and then supposedly take a sample that would be representative of aquifer water. Clearly, from some of the testimony we have had this morning, the more serious problem is when the water stands in the system. I think in order to get a better look at the problem we need the kinds of studies that have been pointed out this morning, which measures lead in the water before the system has been flushed.

Senator LAUTENBERG. Are any people here from EPA? Not to deny the value of the testimony of those who are sitting at the witness table, EPA's views may, in some way, compliment or challenge the positions that were taken. I wonder if I could run through a quick series of questions and at least let you have the opportunity to respond for the record if there is any disagreement or if you want to add anything. That applies to the witnesses and the people from EPA.

Do you want to pull up a chair, either one or both of you, and just quickly go through these? You can decide whose ball it is when I throw these out there.

Does the agency regard lead in drinking water as a serious problem affecting the public health.

Mr. COTRUVO. Yes, we do.

Senator LAUTENBERG. Are there studies that the agency has conducted to identify and to quantify the problem?

Mr. COTRUVO. Yes. There are numerous studies including part of Mr. Murrell's.

Senator LAUTENBERG. The corrosion of pipes and solder in the distribution system, is that regarded as a primary source of lead in drinking water?

Mr. COTRUVO. Yes. That is most significant. In fact, it is the primary source of several substances that are associated with piping and distribution. That whole subject area of corrosion control is

one of the major areas that we are dealing with as we are developing revised regulations for various substances.

Senator LAUTENBERG. There are factors, not only the material and the raw water quality, that determine whether corrosion of pipes result in lead contamination. Is that correct?

Mr. COTRUVO. Yes.

Senator LAUTENBERG. The factors are those that we have heard discussed today by Mr. Murrell and others, acidity and changing chemistry, if you will, of the water supply?

Mr. COTRUVO. Yes.

Senator LAUTENBERG. OK. Of the options we can take to reduce this threat, what options do you see that can be taken to identify the threats?

Mr. COTRUVO. There are two general issues, and I think it has been mentioned. One of them, of course, is old existing piping and what you would do about that. The other is what you would do about new installations. The proposals relate principally to new installations. They certainly would reduce the amount of lead that would come from that source.

The matter of dealing with old piping, and that is, of course, most of the piping, is one that we have been dealing with and will be expanding in the regulations in the respect of both probably a change in the maximum contaminant level—it is 50 now, and it would likely be reduced in the future—second, changes in the way sampling is conducted so that it would be directed toward those areas where the risk is the greatest, where the likelihood of finding the lead is the greatest therefore, in effect, making the regulation more restrictive simply by forcing worst-case analysis, and third, similarly in the way data would be manipulated in determining compliance. So, those are the things that we are working on in dealing with existing systems.

The bottom line on the whole thing is controlling the corrosivity of the water, because if one can make adjustments to the pH or the alkalinity at the water treatment plant, that will definitely reduce the leaching of whatever substance it is that you are concerned about in the distribution system. We did take an initial step in that regard in 1980 when we had a regulation that dealt with identification of the materials used in the plumbing system and then a requirement that those be related to the corrosivity of the water and then activities be taken to try to control the corrosivity if that was a problem.

The bottom line question has been kind of a knotty issue and that is the responsibility of the public water supplier. Is it responsible for the water in the street main, on the other side of the meter, or at the tap? As far as our interpretation of the Safe Drinking Water Act regulations, the responsibility of the water supplier extends all the way to the tap for anything that he has control over, and we think corrosion control and corrosive properties are things that the water supplier has control over.

Senator LAUTENBERG. So, the step proposed by this legislation is to reduce the problem in the home or in the building. That looks like it. The question of whether or not we are sufficiently monitoring the public water system's delivery of adequately controlled

chemistry in the water supply is another way to affect this, and we will have to take a look at that.

We are so pressed for time that even though there is a lot of material that has to be covered, I would ask if each of you would accept questions from us in writing and be prepared to submit your responses.

We have had no opponents offering to testify. It is very interesting. It suggests that this has overwhelming support. I don't even hear from the suppliers yet. I guess they will have something to say, but certainly this Senator identifies with the concerns expressed by this panel and by my colleague from New Jersey. I hope that we will be able to very quickly remove a health hazard that at least has some measure of control ability attached to it and affects the health of our kids and our families.

I thank you all for being here today. I am sorry that we took so long, but that is what happens when you have good testimony. Thank you all very much.

[Whereupon, at 12:06 p.m., the committee recessed, to reconvene subject to the call of the Chair.]

[The study referred to by Senator Mitchell, a background paper submitted by Mr. Svenson, and the bill, S. 1197 follow:]

RECENT MAINE PUBLIC HEALTH LAB DATA THAT LINKS SIGNIFICANT INCREASED LEAD CONCENTRATIONS IN WATER SYSTEMS WITH LEAD SOLDERED JOINTS

By Richard French and John Krueger
State of Maine Public Health Laboratory

The National Academy of Sciences' Drinking Water and Health states under lead; "No beneficial effects of lead on human or animal development have yet been found. Although acute lead poisoning is rare, chronic lead toxicity is severe and occurs even with low daily intake of lead (< 1mg/liter) because of its accumulation in bone and tissue. - The lead concentration in municipal supplies at the tap may be much greater, however, for soft, low pH (aggressive) waters will dissolve lead from service connections, lead lined household piping or soldered joints." The study further states: "Although satisfactory for a 70 Kg adult, the WHO recommendation of 5 ugof lead per Kg/day as a safe total daily intake cannot be met for a 12 Kg child, when the water supply contains as much as .05 mg/liter. It is concluded that the non-observed-adverse health effect level cannot be set with assurance at any value greater than .025 mg/liter."

Background

In February of this year the engineering firm of Holzmacher, McLendon and Murrell P.C. (H2M) sent the Public Health Laboratory information summarizing testing performed in the states of Delaware, Oregon, Wisconsin, Minnesota, Washington, Virginia and Illinois which linked high lead concentrations in drinking water

with lead soldered pipe joints. These studies have further lead to the passage of legislation to ban the use of lead solder for drinking water systems in many of these states.

In each of these studies, a significant number of "first draw" samples, (water left standing in the plumbing overnight), were over the maximum contaminant level (MCL) of .05 mg/liter for lead. These high lead levels were directly linked with the leaching of lead from lead soldered pipe joints.

The Public Health Laboratory acted on this information and initiated a study of lead levels in private homes with their own water supply (well, spring, etc.). Each person requesting a "B" water test, was given an extra sample bottle with special instructions for taking a "first draw" sample. The other sample bottles were to be filled in the usual manner by flushing the water system for 5 to 10 minutes before sampling. The "first draw" samples and the regular sample were analyzed for lead levels. This information was recorded as well as the identification number (serial number), the town the supply is located in, and the age of the water source on data summary sheets.

Lead Survey Results

To date 440 samples have been analyzed for lead with 18 samples (4%) with results over .05 mg/liter and 33 samples (8%) with lead concentrations over .025 mg/liter. The lead values ranged from not detected to as high as 1.26 mg/liter.

The present data indicates that there is a problem with lead solder but the incidences of high lead levels are much lower than the surveys of other states.

This is due to the difference in the types of water samples analyzed. In the Public Health Lab survey, most of the samples were from wells with high hardness levels and pH levels 7.0 or greater. These samples would be classified as nonogressive water and would not cause the gross leaching of lead with more ogressive waters (soft water, pH below 7.0) examined in other states' surveys.

A more recent survey demonstrating the lead leaching of crossive water (ogressive) is the survey of the Morris County reservior in New Jersey which was published in the Journal of Environmental Health, Volume 445, No. 4, pp 179-181, 1983. In this survey 32% of the samples analyzed had lead levels over the MCL of .05 mg/liter.

The Public Health Laboratory is presently initiating with the cooperation with Health Engineering a new survey of twenty public water systems. Fifteen of these systems have ogressive water as classified by the Langelier Index. The other five systems have nonogressive water for comparison. A number of "first draw" samples as well as regular samples from each system will be analyzed for lead. This survey will better represent the extent of the lead problem in Maine. The data should be available this fall.

More information on the extent of this problem nationally will be presented at the AWWA Technical Program Tuesday June 25, 1985 in Washington, D.C.. The speaker will be Norman Murrell of H2M.

RF/JK/car

STATE OF NEW YORK
DEPARTMENT OF HEALTH OFFICE OF PUBLIC HEALTH
CORNING TOWER • THE GOVERNOR NELSON A. ROCKEFELLER EMPIRE STATE PLAZA • ALBANY, N.Y. 12237
DAVID AXELROD, M.D.
Commissioner
LINDA A. RANDOLPH, M.D., M.P.H.
Director
WILLIAM F. LEAVY
Executive Deputy Director

Lead in Drinking Water: Request for Uniform Code Revision

1. Health Effects of Lead Ingestion (Why lead in the environment is a public health concern).
2. Significance of Lead Content in Drinking Waters.
3. Lead Solder Substitutes.
4. Enforcement of Lead Solder Ban.
5. Suggested Changes to Uniform Code (Amendments needed to ban use of solder containing more than .2% lead in new construction).
6. References.

3/85

LEAD IN DRINKING WATER

Health Effects of Lead Ingestion

Lead has no known useful function in the body and exerts adverse effects on both adults and children. Children are exposed to lead from many sources--food, air, water, dust, soil, paint, and other products. They also absorb 50% of ingested lead while adults absorb 8-10% of ingested lead. In the United States, one low-dose lead source is usually insufficient by itself to produce lead toxicity. The average, healthy 3-year-old child can excrete about 150 micrograms (ug) of lead per day. This same child will ingest 100 to 125 ug of lead daily from uncontrollable sources; this leaves a margin of safety of only 25 to 50 ug/day. The margin is further reduced by a child's "youngness" and nutritional disadvantage.

Any addition to the total body burden of lead is undesirable for any group but is particularly hazardous for certain high-risk groups. The largest of these groups consists of the unborn, infants, and young children. Lead toxicity is associated with a high risk of central nervous system damage in children. Repeated exposure to high environmental levels of lead greatly increases the risk of irreversible damage.

Pediatric lead poisoning remains a major problem, especially for the approximately 16 million children ages 1-5 in the United States (1980 Census Data). Since the inception of the Childhood Lead-Based Paint Poisoning Prevention Program in 1973 (U.S. Public Health Service, Centers for Disease Control), 3,900,000 children have been screened and 243,000 (6.1%) found with lead toxicity. In FY 1981, 535,000 children were screened and 22,000 had lead toxicity (4.1%).

It should be noted that the Centers for Disease Control (CDC) has issued new guidelines for preventing lead poisoning in children. The guidelines are used in State lead prevention programs. Studies since 1978 demonstrate that little or no margin of safety is provided at a level of 30 micrograms of lead per deciliter (ug/dl) of whole blood, the previous limit for lead poisoning. Accordingly, CDC has lowered it to 25 ug/dl. Previously, lead toxicity was defined as 50 ug/dl or greater, and CDC has lowered it also to 35 ug/dl.

The second National Health and Nutrition Examination Survey (NHANES II) conducted by the National Center for Health Statistics (1976-1980) provided data showing that 18.6% of black children living in inner cities of urban areas of 1,000,000 or more population had blood lead levels in excess of the recommended action level. Findings for other groups include. white inner-city children, 4.5%; children from similar urban areas (less than 1,000,000 population), 3.5%; and children from rural areas, 2.1%.

EFFECTS ON BLOOD CELL FORMATION

Lead partially blocks blood cell formation by inhibiting the effect of certain enzymes. It can also shorten the life of red blood cells, the clinical end point being anemia. Lead-induced anemia appears to occur at a much lower lead level in children than in adults and is often accompanied by iron deficiency.

NEUROLOGICAL EFFECTS

Children are more susceptible than adults to lead-induced central nervous system (CNS) dysfunction because their nervous system is immature and still developing.

At high blood lead levels, acute encephalopathy (swelling of the brain stem) may develop which can lead to seizures, coma and, if left untreated, death. Lead can also cause an actual loss of neurons in the brain. This effect is irreversible (Goyer 1982).

Lower blood lead levels can cause sub-clinical effects including clumsiness and irritability (Pueschel et al. 1972).

Needleman reported in 1979 that children with sub-clinical blood lead levels performed less well than their lower lead counterparts in a broad spectrum of intellectual, motor skills and behavioral parameters.

RENAL EFFECTS

Lead has been shown to cause both acute and chronic kidney disorders. Fancon's syndrome and hypoaminoaciduria has been documented by several researchers. With treatment, these acute disorders are reversible.

Chronic, irreversible effects of lead nephropathy have been demonstrated in experimental animals and persons with continued occupational exposure to lead.

EFFECTS ON THE FETUS

Conclusive evidence exists showing that lead crosses the placenta and accumulates in fetal tissues in both humans and animals (NOISH 1978, Jaworski 1979). The blood lead level of the fetus corresponds closely to the maternal blood lead level; however, a proportionally greater percentage of the total body burden of lead is accumulated in the fetal brain (NIOSH 1978, Drill et al. 1979).

Beattie et al. reported in 1975 an association between mental retardation and the ingestion of high concentrations of lead (>800 ug/dl) in drinking water during pregnancy.

Beyond the personal tragedy, lead toxicity places a substantial economic burden on society. Provenzano (1980), estimated the cost for medical care and special education for preschool-age and school-age children affected by lead at $971 million in 1978. More importantly, because special education costs are three times those for medical care, he concluded that as preschool-age children grow older, the social costs of these exposures "snowball." The psychological deficits and behavioral disorders produced by low-level lead exposure are not reversible. Thus, the costs--both human and economic--of children afflicted will remain with us for a long time even if we succeed in reducing the future exposure of our children to all unnecessary sources of lead.

There is overwhelming evidence regarding the accumulative adverse effects of lead poisoning in children from a multiplicity of sources, e.g., air, food, lead containing paint, soil and dust, and water--all of which contribute to the overall body burden.

More attention needs to be given to the chronic low level lead exposure sources, such as high lead concentrations in our water supplies. Numerous studies and data show that excessive lead concentrations can be caused by the leaching of lead from lead containing service piping, water vessels and soldered joints, especially in corrosive water situations.

In summary, lead is a multi-source hazard that we must recognize when we consider strategies for reducing total exposure to our children. Eliminating, or at least minimizing, any of these sources must be given the utmost consideration.

LEAD IN DRINKING WATER

Significance of Lead Content in Drinking Waters

The ability of water to leach lead from lead-containing piping and solder (plumbosolvency) is dependent on various chemical and physical factors including; the chemistry (pH and alkalinity) and temperature of the water; time of contact between water and plumbing; and the age and condition of the lead plumbing.

Waters with a pH of less than 7.0 are usually designated as corrosive waters. Also temperatures in excess of 20 degrees Centigrade (20°C) will generally increase corrosivity.

The greater length of contact time (periods of stagnation) also increases amount of lead leachate occurring with a corrosive water supply. It has also been established that newly soldered joints are much more plumbosolvent than soldered joints in service for at least a year.

Studies in Victoria, British Columbia, Canada (Wong and Berrange 1976), determined that the plumbosolvency of the city's water supply could produce water lead concentrations above the current Federal Safe Drinking Water Act standard of 50 micrograms per liter (50 ug/liter). In a one year old home with a copper plumbed water system using 50 percent lead solder the standard would be exceeded within 4 to 20 hours of stagnation. In homes using a lead piped water system the lead concentration could rise above 50 ug/liter in as little as 10 to 100 minutes.

Studies conducted in Long Island, New York, by the consulting firm of Holzmacher, McLeondon and Murrell, P.C., (1982 and 1983, Melville, NY) found high concentrations of lead in drinking water at private residences and commercial facilities. Residential concentrations in first flush water samples were as high as 400 ug/liter subsequently reducing to five(5) ug/liter after two(2) minutes of flushing. In newly constructed homes, levels of 7100 ug/liter were found, while in commercial facilities concentrations between 5 to 280 ug/liter were reported. These data resulted in the Suffolk County Legislature recommending a ban on any solder containing more than 0.2% lead, along with suggestions to new homeowners to flush a year's supply of water through the plumbing system before use and all residents to flush at least two(2) liters of water from the plumbing system after periods of stagnation.

Matthew (1981) reports that in Great Britian lead concentrations in drinking water contributes significantly to the overall lead body burden. Approximately 10% of households had lead concentrations above 50 ug/liter and another 25% contained lead levels between 10 and 50 ug/liter. The average daily consumption of water by an adult ranges from 1.25 to 2.9 liters. If the water supply contains 50 ug/liter lead then the overall lead intake will range from 62.5 to 145 ug/day. Bottle fed infants take in some 7.5 times more lead from water than an average adult for each unit of body weight. Infant water consumption averages 0.15 liters/kg./day, which will contain 7.5 ug lead/day/kg., if the water supply contains a 50 ug/liter lead concentration.

Thomas et al. (1979) conducted studies in which it was shown that the removal of lead piping in a Welsh housing estate reduced the average blood lead levels of residents by 25% within a six-month period.

Beattie, et al. (1972) showed a correlation between water lead concentrations and the amount of lead piping. Residents in these houses showed an average increase in blood lead concentrations as the water lead concentrations increased; a rise of 1 umol/liter in water lead resulted in a 0.2 umol/liter rise in blood lead.

There are numerous other studies on record clearly showing that individuals exposed to elevated water lead concentrations have pronounced increases in blood lead concentrations.

At least three (3) documented cases of lead poisoning in New York State were determined to be caused by high concentrations of lead in drinking water.

A listing of selected municipal water supplies in New York State is provided in the attached table. Data presented include the water supply source, average pH and alkalinity measures, an estimated corrosion index based on the previous averages. As seen, the corrosivity of water supplies across New York State is variable, but the overall effected population is significant in this sample group. It should also be noted that electrical grounding will increase the corrosivity of water independent of these corrosion estimates. Thus, the estimated effected population will again increase in situations where electrical systems are grounded on water system pipes.

The problem of corrosivity in potable water plumbing utilizing individual water supplies (wells) is difficult to define. Normally, a chemical analysis of these systems is not performed and, therefore, existing data is limited. It is known, however, that shallow water sources, such as dug wells, springs and surface water supplies, are more corrosive in nature due to the lower pH and alkalinity values. Presently there are approximately 800,000 (11%) New York State households that obtain their drinking water from individual sources.

LEAD IN DRINKING WATER

Corrosion Index of Municipal Water Supplies

(A Cross-Section Sample of New York State)

Community	Population	Source*	pH	Alk**	Corrosion Index***
Albany (C)	101,767	S	7.8	31	M
Binghamton (C)	60,000	S,G	7.1	40	M
Limestone (V)	550	G	6.7	56	H
Auburn (C)	32,548	S	7.8	102	L
Batavia (C)	16,700	S,G	7.6	25	M
Dunkirk (C)	15,310	S	7.8	105	L
Plattsburg (C)	21,057	S	6.5	56	H
Poughkeepsie (C)	65,000	S	7.6	47	M
Buffalo (C)	357,870	S	7.5	105	L
Akron (V)	3,640	S	7.3	40	M
Lake Placid (V)	3,500	S	6.7	8	H+
Gloversville (C)	19,000	G	7.1	25	M
Old Forge (V)	3,000	S	6.3	6	H+
Watertown (V)	35,000	S	6.8	38	H
Rochester (C)	225,000	S	7.4	70	M
Utica (C)	75,632	S	7.5	15	H
Syracuse (C)	170,105	S	7.5	90	L
Newburgh (C)	23,438	S	7.6	98	L
Unadilla (V)	1,350	G	6.8	67	H
Massena (V)	15,000	S	7.8	74	L
Schenectady (C)	67,972	G	7.8	123	L
Corning (C)	12,953	G	7.5	155	L
Warrensburg (V)	2,400	S,G	6.9	25	H
New York City (1)	6,552,718	S	6.8	35	H

(1) New York City varies from High to Moderate depending upon where sampled and which supply the sample is collected from.

*Source: S = surface; G = Ground or Subsurface; S,G = Combination of surface and ground.

**Alkalinity: Expressed as milligram/liter (mg/l) of Bicarbonate ($CaHCO_3$) Alkalinity.

***Corrosion Index: H+ - Very High = pH less than 7.0 and Alkalinity less than 20.
H - High = pH less than 7.0, or Alkalinity less than 20.
M - Moderate = pH 7.0 - 7.8, and Alkalinity of 20 - 80.
L - Low = pH greater than 7.8, and/or Alkalinity of greater than 80.

LEAD IN DRINKING WATER

Substitutes for Lead Solders

If the goal of reducing lead concentrations in drinking water is to be effected, a substitute for leaded solder used in sealing copper piping joints must be available. There are several substitutes currently on the market which are of better quality materials than leaded solders. These substitutes, which provide better sealing properties along with lower corrosivity, include Tin/Antimony solder (95%/5%), and various Tin/Silver solders; most commonly in a combination of 96% and 4% respectively. The following table shows comparative data regarding the three solder types:

Material	Percentage	Melting Range (°F)	Shear Strength (psi)	Time to Fracture at 1000 psi (Hours)	Approximate Dealer Cost (J.W. Harris Co.) (1 pound)
Tin/Lead	50-50	361-420	5599	5	$ 4.50
Tin/Antimony	95-5	451-464	7847	456	$ 8 00
Tin/Silver	96-4	430-473	10747	10776	$20 00

Data indicate that both substitute materials provide a stronger seal than Tin/Lead (50/50) solder when comparing shear and creep strength. The working temperature ranges are somewhat higher making Silver and Antimony solders slightly more difficult to work with.

The Tin Research Institute and the American Welding Society are in agreement that the use of Tin/Antimony solder on brass fittings or joints is not recommended due to an effective embrittlement of the base metal. This distinct disadvantage of Antimony solder is not present with Silver containing solder use.

The economic impact of banning Lead containing solder appears to be high at first examination. The percentage cost increase of Tin/Antimony over Tin/Lead solder would be approximately 170% while Tin/Silver solder costs are 400% higher. However, in considering the total cost of a plumbing system in a new home, including piping, labor, solder, etc., the overall increase would be slight. The use of one pound of solder per home plumbing system would be a maximum. The added cost would also be offset by the increase in durability and strength, especially if future repair costs of broken joints are considered.

Consideration has been given to the health impact of these substitute solders, particularly because of the known toxicity of the metal Antimony; however, in an Environmental Protection Agency study (Herrera et al. 1982), the increases in the water concentration of Antimony from the corrosion of sealed joints were found to be minimal. Leaching was inhibited by the formation of chemical bonds creating a protective layer of Tin, thus reducing corrosion. In concurrent tests comparing Tin/Lead and Tin/Antimony solders, there was a substantial reduction in water Lead concentrations when using the latter, with no significant Antimony levels produced.

Preliminary indications from the Silver industry indicate that Tin/Silver solders also are much more corrosive resistant than Tin/Lead solders.

LEAD IN DRINKING WATER

Enforcement Mechanisms - Lead Solder Ban

The problem of enforcement of a ban on the use of leaded solders in drinking water plumbing may initially be difficult to administer in a consistent manner. The most feasible and practical methodology is the use of spot inspections by building and plumbing inspectors, as follows:

1. A qualified inspector should be able to visually or physically determine if the use of a leaded solder is suspect because of its pliability; a pen knife will easily scratch the surface of a lead containing soldered joint.

2. If lead solder is suspect, it is relatively easy to scrape the exposed or excess solder from a joint with a pen knife into an envelope. Testing of the sample by any qualified laboratory with Atomic Absorption Spectrophotometry can determine the amount of lead in the solder to a tenth or a hundreth of a percent. The cost of this test averages about $20.

3. The threat of penalties, including the costs of replacing the illegal joints/materials, where violations have been found will act as a major deterrent to most installers. Contact with the Chief Plumbing Inspector for the City of Seattle, Washington, where a ban currently exists on leaded solders (0.2% maximum) revealed that this is, in fact, the case. He also stated that the problem with enforcement is practically nonexistent at this time. This also is the procedure for enforcement currently being followed in those Long Island communities where leaded solder in drinking water plumbing is prohibited [at least 25 local municipalities (towns and villages) currently are enforcing a ban on the use of solders containing more than 0.20% lead].

Other States that currently are enforcing a ban on the use of lead containing solders and/or other joining compounds:

1. Delaware - Requires that joints shall be properly fluxed and made with solder conforming to ASTM B32, provided that the lead content shall not exceed 0.20% for potable water systems (Department of Health and Social Services - Division of Public Health - regulation).

2. Oregon - Prohibits use of solders containing more than 0.20 percent lead; requires labeling of solders with more than 0.20 percent lead; prohibits use of plumbing piping for electrical grounding; and, prohibits use of lead pipe in any potable water supply (Oregon State Health Division - Lead Solder Rule, Department of Human Resources).

3. Wisconsin - Effective September 18, 1984, enacted an emergency rule (150 days) which prohibits the use of lead containing solders and fluxes for joining copper water tubing, i.e., "The surfaces to be soldered shall be cleaned and a lead-free flux shall be applied to all joint surfaces. The joint shall be made with a lead-free solder." The proposed permanent rule currently being proposed by the Department of Industry, Labor and Human Relations defines lead-free as meaning a chemical composition equal to or less than 0.2% of lead.

Other States currently considering a ban on the use of lead solders in drinking water plumbing include Connecticut, Louisiana, Pennsylvania and Virginia. In addition, a California plumbers' union is urging that State's Department of Housing and Community Development to enact a ban on the use of solder containing more than 0.20% lead in water-supply plumbing.

Further support comes from the United States Environmental Protection Agency (EPA). Although EPA may not have legal authority under the Safe Drinking Water Act to ban the use of lead or other materials in potable water systems, EPA has diligently sought to discourage the use of lead in water supply plumbing. A specific quote from page 57350 of the Federal Register of August 27, 1980 (Vol 45, No. 168), Part IV of the Interim Primary Drinking Water Regulations is as follows:

> "The Agency is encouraging the practice of replacing lead pipes conveying drinking water in existing systems. In addition, EPA is actively pursuing the elimination of lead from plumbing code specificiations as an acceptable material for the transportation of drinking water."

In 1985, EPA also made written recommendation to BOCA (Building Officials and Code Administrators International, Inc.) to take steps to remove lead materials from its model code, i.e., BOCA Basic/National Plumbing Code.

LEAD IN DRINKING WATER

Necessary Revisions to Uniform Code

To effect the goal of reducing lead concentrations in drinking water in New York State, future construction or replacement of water distribution systems must be of materials containing no more than 0.20 percent lead. In order to accomplish this, the following Code changes must be enacted in the New York State Uniform Fire Prevention and Building Code (Uniform Code):

Current Regulation

902.2a-1 (pg. 250) No piping materials that could produce toxic conditions in the potable water supply system shall be used in such system.

Recommentation: No piping or plumbing materials that could produce toxic conditions in potable water supply systems, including materials containing greater than 0.20 percent lead, shall be used in such system.

Current Regulation

902.8h-5 (pg. 260) Lead pipe, horizontal, support continuously for entire horizontal length.

902.8h-6 (pg. 260) Lead pipe, verticle: 4 feet.

Recommendation: Delete both sections.

Current Regulation

905.5 (pg. 305) Copper Tube Solder Joints. Surfaces to be soldered in copper tube solder joints shall be cleaned bright, properly fluxed, and the joint made with solder approved for such use. Lead content in solder shall be limited to 0.20 percent when it has been determined by the authority having jurisdiction that a higher lead content constitutes a health hazard.

Recommendation: Copper Tube Solder Joints. Surfaces to be soldered...approved for such use. Lead content in solder shall be limited to 0.20 percent in all potable water supply systems.

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Lead in Drinking Water Supplies

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II

99TH CONGRESS
1ST SESSION

S. 1197

Entitled the "Lead Free Drinking Water Act".

IN THE SENATE OF THE UNITED STATES

MAY 22 (legislative day, APRIL 15), 1985

Mr. BRADLEY (for himself and Mr. LAUTENBERG) introduced the following bill; which was read twice and referred to the Committee on Environment and Public Works

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A BILL

Entitled the "Lead Free Drinking Water Act".

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

That on page 51, after line 3, insert the following:

"SEC. 16. Part B of the Safe Drinking Water Act is amended by adding the following new section:

" 'PROHIBITION ON LEAD USE

" 'SEC. 1417. (a) After the date of enactment of the Safe Drinking Water Act Amendment of 1985, no lead pipes or lead solder shall be installed or used in the installation or repair of any distribution system for drinking water, including but not limited to, public water systems, residential and non-

residential facilities for the provision of piped water for human consumption, and their connections to such systems. Not later than two years after such date of enactment, each State shall be responsible for implementing the provisions of this subsection in the appropriate State codes. Any State failing to implement such provisions shall be ineligible to receive funding under section 1443(a) of the Act. Enforcement of this subsection shall be through appropriate State or local plumbing code inspectors.

" '(b) Beginning not later than nine months after such date of enactment, any lead pipes or lead solder sold in retail establishments shall contain a label clearly stating that use of lead pipes or lead solder in drinking water supply systems is prohibited under Federal law.

" '(c) Not later than three months after such date of enactment, the Administrator shall notify the Governor of each State of the requirements and effective date of this section.

" '(d) Not later than two years after such date of enactment, each public water system shall notify all users of the system of the adverse health effects of lead exposure (including a description of any sensistive populations) and means reasonably available to such users of mitigating lead exposure from drinking water.' ".

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